Hedging With Derivatives and Firm Value

by

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Abstract

This study examines the impacts of risk management strategies with derivatives on firm's market value using a sample of non-financial firms listed in the FTSE-350 share index at the London Stock Exchange between 2005 and 2013. We focus on the derivatives use to hedge both the foreign exchange risk and the interest rate risk. To avoid, as far as possible, the endogeneity among variables and consequently strengthen the tests, it is employed an instrumental variables approach in addition to the OLS with time and industry fixed effects. The results reveal a positive effect of foreign currency derivatives and interest rate derivatives on firm's market value, which indicates that investors, at least under the conditions described in the study, appreciate these risk management practices and reward them with higher market values. However, if we attempt to the derivative contract employed – forward, option, swap - their impacts on firm value differ. For instance, while swaps use to hedge the interest rate risk or the forward contracts to hedge the foreign exchange rate risk have positive and significant effects on value, this effect is not clear when we employ an option contract.

Keywords: Hedging, Derivatives, Firm Value, Risk Management

JEL Codes: G3, F3, F4

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1. Introduction

Derivatives have grown in importance in the last decades and assume a key role in the financial markets. John Hull (2011) states that "Whether you love derivatives or hate them, you cannot ignore them! The derivatives market is huge - much bigger than the stock market when measured in terms of underlying assets. The value of the assets underlying outstanding derivatives transactions is several times the world gross domestic product."

Adding to this, the risk management is also a relevant subject. More importantly, the risk management through financial hedging has become increasingly pertinent in recent years. As mentioned in Campello et al. (2011), "the world's largest companies use derivatives to hedge their business and financial risks"[1]. In fact we can say that these mechanisms of risk management are the norm rather than the exception.

According to Modigliani and Miller (1958) the risk management has no impact on firm value since in the presence of perfect capital markets the companies' financial policies are irrelevant and shareholders can implement their own risk management strategies at the same cost. However, if the perfect markets' assumptions are relaxed and the information asymmetries, transactions cost or taxes are taken into account, it is possible that hedging add value as postulated by some modern financial theories (for instance, Smith and Stulz, 1985). On the other hand, empirically, the relation stablished between hedging policy and firm value is not consensual and "most empirical studies fail to account for the endogeneity of variables" (Ahmed et al. 2013). These assertions enable us to claim that several central questions on the effects of hedging with derivatives remain unanswered. In this sense, the current research intends to bring new empirical evidences to literature in order to increase, as far as possible, the knowledge on this relevant topic.

[1] In accordance with the International Swaps and Derivatives Association (ISDA), in the year 2009, about 94% of the world' largest companies used financial derivatives to manage or hedge their business and financial risks. The survey was based on the derivatives usage by the world's 500 largest companies. Further, the same survey shows that the foreign exchange derivatives are used by 88% of the sample firms while in case of the interest rate derivatives this number reaches the 83%. Other interesting findings are available on the organization's website (*www2.isda.org*)

Therefore, the main concern of this study is to examine the effects of hedging derivatives on firm market value. As in Bartram et al. (2011) and in Ahmed et al. (2013), we focus simultaneously on multiple risk exposures, the interest rate risk (IR risk) and the foreign exchange rate risk (FX risk). To enhance the accuracy, in a secondary analysis, we also consider the derivative contracts individually (Swaps, options and forward contracts). The distinction of the type of contracts is not commonly implemented in the literature for what constituted a distinctive factor and a plus of the current work. In the first step of this investigation, it is addressed the question of whether the use of derivatives to hedge the FX risk or the IR risk have a positive impact on firms' market value, regardless the type of contract. In other words, the analysis intends to identify the market behavior in response to the use of foreign exchange derivatives and interest rate derivatives by a listed company. Subsequently, the tests are reproduced but this time taking into account the contracts applied to hedge each risk exposure, i.e. it is examined the impact of a particular derivative (swap, option or forward) used to hedge a particular risk (foreign exchange risk or interest rate risk). The aim with this new analysis is to realize whether the use of different derivative contracts produces different outcomes, regarding the impact on firm value.

To pursue our empirical tests it is used a sample which comprises non-financial firms listed in the FTSE-350 share index at the London Stock Exchange (LSE) similarly to the study of Ahmed et al. (2013) that focus their analysis on the FTSE-All Shares. Actually, the UK financial market is one of the most developed in the world and where a large part of the most relevant European companies are listed on. A set of studies had been done around this subject, nonetheless, the majority focus on North American firms. Therefore, the choice of this sample present on our study aims to highlight the hedging strategies and their impacts but this time on the European context, using companies listed on the reference Stock Exchange in Europe. Logically, if the concern of this empirical study is based on the effects of hedge on firm's market value, we indirectly examine the market's reactions and consequently the data should reflect only listed companies, in this case firms listed on the FTSE-350.

In respect to the data collection process, two different resources were used, the gather of information through a database and the manual collection. The financial and accounting data were obtained from *Bureau Van Dijk Amadeus Database* while the details on

hedging derivatives were directly collected from the firms' annual reports in a manual and time consuming process[2]. The data cover a period of nine years, from 2005 to 2013 and the final sample includes a total of 130 firms, resulting in an overall and considerable number of 1170 observations. One of the most relevant information gathered through annual reports is the gross notional values of derivatives[3]. Contrary to other similar studies (for instance, Allayannis et al., 2012, Ahmed et al., 2013 or Chaudhry et al. 2014) that make use of binary variables distinguishing solely hedgers and non-hedgers, in the current work are used continuous variables that allow us to capture the "intensity" of hedging activities with derivatives. This "intensity" measure is roughly the weight of derivatives' notional values relative to the firm's size (measured by the firm total assets) (see Campello et al. 2011 or Marami and Dubois, 2013). As in Rossi Junior and Laham (2008), Bartram et al. (2011) and Allayannis et al. (2012) among others, we use the *QTobin* as a proxy for the firm market value. Thus, QTobin is the dependent variable in this analysis[4].

It should be noted that the transactions associated to derivatives have different intentions and in this research we request merely the derivatives used with hedging purposes (i.e. derivatives used as a way to reduce the volatility of firms' cash flows). Other purposes as speculation or trading (strategies that involves a high level of risk in which the gains comes from the price variations) will not be considered, since they have associated other objectives than risk management. In this context and according to previous literature, it

[2] Exceptionally, the information about dividends' distributions was collected from *Thomson Reuteurs Database* due the unavailability of this specific data for the most companies on the Amadeus Database. The match between two databases will be explained on the Data section.

[3] From the information disclosed in the annual reports, it is collected data on the notional values of forward, options and swap contracts (in thousands of pounds), to hedge FX and IR risks. Additionally, it is collected, to each firm, the total of foreign assets per year, the total assets held in foreign countries and also the existence of debt denominated in a foreign currency (measured as a dummy variable).

[4] Following the previous authors, it is applied an approximated definition of *QTobin*, due the unavailability of data to develop the original definition (namely in respect to the replacement costs of assets). The *QTobin* is defined as the book value of total assets less book value of equity plus market value of the equity, scaled by the book value of total assets. This Question will be addressed further in a next section.

is important to remind that the nonfinancial companies' use of derivatives is mainly for hedging purposes and these risk management strategies are usual.

Econometrically, the presence of endogeneity among variables, documented in previous researches, may affect the interpretation of the results. Thereby, apart from the OLS method it is performed a two-stage least squares instrumental variables approach (IV). This new method of estimation helps to mitigate the endogeneity issue and complements the OLS regressions, making the tests more robust and reliable. Furthermore, in both methods of estimation are included time-fixed effects and industry dummies.

Our main findings can be summarized in two distinct fields. First, the results suggest that the derivatives use to hedge the foreign exchange rate risk is positively and significantly associated to firm value either using OLS method or the two-stage least squares method. Similar results were found in respect to the interest rate risk hedge, however in this particular instance the positive effect of IR derivatives is only statistical significant in one of the methods (2SLS). The positive impact of derivatives discussed here is a clear signal that investors perceive the use of derivatives as hedging instruments and consequently the market reward these firms with an increase in their market values.

Second, the specification of derivative contracts shows different patterns of behavior. While the use of some derivative contracts presents also a positive impact face to firm market value, others are associated to insignificant or even value-destroying impacts. This result leads us to argue that the choice of contract is an important factor to consider, due the different reactions of investors face the different derivatives used. Actually, some derivatives appear most effective to hedge a specific risk than others, once the effects of manage a particular risk exposure vary across the type of derivative contract used.

This research contributes to the literature in several aspects: we focus simultaneously on the type of risk hedge (foreign exchange risk and interest rate risk) and on the type of contract used in the hedging strategy (forward, future, option, swap). The large part of papers develop analyses based only on a single risk exposure, as foreign exchange risk (Allayannis and Weston, 2001, Rossi Junior and Laham, 2008 and Allayannis et al. 2012) or interest rate risk (James Vickery, 2008, Beatty et al. 2011 and Marami and Dubois, 2013) and do not analyze the contracts separately. Our research have a similar design to Ahmed et al. (2013) that also take in account the type of contract, however, it differs in

the hedge variables construction. While Ahmed et al. (2013) and other authors such as Allayannis et al. (2012) and Pérez-González and Yun (2013) use a simple dummy variable to distinguish hedgers and non-hedgers in this study it is followed a different methodology. To capture the hedging activities it is constructed continuous variables, using the gross notional value of each derivative (swaps, forward, options) face to each risk exposure (foreign exchange rate or interest rate) instead of dummies variables. This procedure takes into account the hedging extent and intensity and not only the hedging use (hedger vs non-hedger), bringing informative power to the analysis. Although the manual process to collect the notional values and other relevant information about hedge policies from the annual reports is time consuming, we expect that the inclusion of the hedging level enlarge the robustness of the results[5] . Finally, as aforementioned, relying on a sample composed by firms listed on a European Stock Exchange, this research give us a general overview of the derivatives' use by companies on the European context and investors' behaviour face to them. As we know, most studies on this topic resort to North American companies to pursue the analysis. Furthermore, we cover a recent time period of 2005 to 2013, which allow us to learn more about the corporate hedging during a financial crisis (2008-2009).

The remainder of the research is organized as follow. Section 2 presents a review of the theoretical and empirical literature related to the topic. In section 3 the hypotheses under consideration are developed while in section 4 the sample and the data collection process are described. Section 5 reports the methodology including the definition of all variables employed in the empirical models. In turn, section 6 shows the univariate and multivariate results and finally section 7 concludes.

[5] As stated by Marami and Dubois (2013) "a simple classification of hedger and non-hedger increases the endogeneity concerns by ignoring the impact of the level of the hedging on firm value".

2. Literature Review

In the absence of market imperfections, Modigliani and Miller (1958) postulate that the risk management has no impact on the companies outcomes and thus, these companies would not engage in hedging strategies once they add no extra value. In these situations of perfect markets, it is possible that shareholders access to financial markets with the same conditions as companies and thereby implement hedging activities by themselves at the same cost. However, in a more realistic viewpoint, if we consider the existence of some frictions on capital markets (as the existence of transaction costs, agency costs, information asymmetries or taxes) firms there may be rational reasons to hedge. The usual explanations used to justify the hedge decisions are, for instance, the reduction of the expected tax liabilities (Smith and Stulz, 1985), the mitigation of the under-investment problem (Froot et al., 1993) and the reduction of expected cost of financial distress (Mayers and Smith, 1982). Summarizing, these authors argue that hedging strategies allow companies to alleviate the aforementioned frictions and consequently may enhancing the firm's value. Another strand of theory developed by Stulz (1984) evidence the agency problems as the main motivations to implement hedging strategies. In this sense, hedging is a result of manager's incentives to maximize their utility, highlighting the idea that risk management can be also based in selfish purposes.

These risk management theories have been tested empirically and distinct lines of investigation are developed. While several works focus on the determinants of hedging activities (Tufano, 1996 and Graham and Rogers, 2002), others examine the nature and extent of derivatives' use by non-financial firms (for instance, Bodnar et al., 1998 or Bodnar et al., 2011). The most recent studies analyze directly the relationship among the use of derivatives with hedging purposes and firm value (for instance, Allayannis and Weston, 2001, Jin and Jorion, 2006, Bartram et al., 2011, Allayannis et al., 2012, Ahmed et al., 2013, Pérez-González and Yun, 2013 and Chaudhry et al., 2014).

Within the works that attempt to the direct relationship among hedging and value we can separate those that are based on specific risk exposure (Allayannis and Weston, 2001, Rossi Junior and Laham, 2008 and Marami and Dubois, 2013) and ones based on a single industry (Jin and Jorion, 2006 and Carter et al. 2006). For instance, Allayannis and Weston (2001) performed an outstanding work on the foreign exchange derivatives and

found a positive effect of their use on the firm value (measured by *QTobin*). This research was one of the pioneers on the direct link between hedging activities and value and documents the use of foreign currency derivatives in a sample of US non-financial firms. The premium associated to the hedging practices is statistically and economically significant and reaches 4.87%.

Similarly, Rossi Junior and Laham (2008) rely on a sample constituted for Brazilian non-financial firms (during a time period of 1996 to 2005) to examine the behavior of firm market value face to the foreign currency hedging as well. While the most studies are based on samples of North American companies, Rossi Junior and Laham (2008) use Brazilian companies to perform the research, which helps to give some lights about this issue among firms from and emerging country. Although the specificity of the macroeconomic scenario, the results show that hedging activities do increase significantly the firm values.

However, some studies focus in different risk exposures than foreign exchange rate, as interest rate risk. For example, Marami and Dubois (2013) attempt to ascertain how the use of interest rate derivatives is related with firm value taking into consideration the voluntarism associated with that use. The use of interest rate derivatives presents a positive impact on the firm value when their use is enforced by creditor and a non-significant impact otherwise.

The three examples mentioned above had relevant contributions to the literature on the theme, namely the first one, which was one of the first works about the subject (direct link between derivatives use and value). On the other hand, the quoted studies only address the effects of derivatives used to hedge a particular risk exposure (interest rate risk or foreign exchange risk), which limits its scope.

The approach by industry is also a common procedure in the design of researches, where Jin and Jorion (2006) and Carter et al. (2006) are included. Jin and Jorion (2006) perform an analysis focusing in a dataset of 119 U.S. oil and gas producers from 1998 to 2001. Contrary to the examples above, Jin and Jorion (2006) findings show a non-significant

impact of the hedging derivatives on value.[6] In a similar way, Carter et al. (2006) investigate whether the hedging is value enhancing or not by resorting to a sample of U.S. airline industry during 1992-2003. This time the results demonstrate a positive relation among hedging and value maximization, suggesting that companies benefit from jet fuel hedging strategies. It is also important to note that the choice by analyzing a singular industry may be related with endogeneity issues. Actually, a way to mitigate the problems that arises from the reverse-causality between hedging variables and value (measured by QTobin) is explore a set of homogeneous firms, for instance, firms from the same industry.

Therefore, and allowing broad analyses, some researches as Bartram et al. (2011) and Ahmed et al. (2013) or Chaudhry et al.(2014) take into account distinct risk exposures and firms from different industries. Bartram et al. (2011) accomplish an extensive analysis to ascertain the consequences of derivatives' use on value and also on firm risk, using a sample that includes a large number of non-financial firms from 47 different countries. Similarly to the current research, they consider simultaneously multiple risk exposures, the foreign exchange risk, the interest rate risk and finally the commodity price risk. With respect to this work, is also relevant mention that the authors employed new econometric techniques based on the propensity score matching to overcome the endogeneity issue and consequently to produce more reliable and robust results. The conclusions show that the derivatives use reduces both total risk and systematic risk while the effects on value are positive but weak. Another curious finding reveals that hedgers significantly outperform non-hedgers during the 2001-2002 crises.

More recently, Ahmed et al. (2013) investigate the link between hedging derivatives and firm value and performance. They address this question with resource to a sample that comprises UK non-financial firms listed on the FTSE-All share index over time period of 2005-2012 and focus on the hedging of foreign currency risk, interest rate risk and commodity price risk with forward, futures, options or swap contracts. The main findings show that "the effectiveness of the risk management practices varies significantly across the financial risks and the derivatives used for hedging". Further, some results contradict

[6] Jin and Jorion (2006) consider only US oil and Gas producers and analyzed their hedging strategies using commodity derivatives (oil derivatives or related).

the previous literature which demonstrates a positive impact of hedging on value by showing a non-significant or even negative relation between some contracts and value or/and performance. Additionally, they conclude that the financial crisis (2008-2009) did not influence significantly the risk management practices, particularly the "firm's commitment to financial risk hedging with derivatives".

Finally, Chaudhry et al. (2014) rely on a less common sample, a sample of Pakistani non-financial firms, and investigate the questions associated with corporate hedging. The authors found that use of foreign exchange derivatives as well as interest rate derivatives with hedging purposes is a value maximization activity.

On the other hand, some authors develop relevant investigations with distinctive perspectives, not just keeping in mind the direct relationship among hedging and value. Although not directly related to the current work, it is worth to mention the abovementioned studies. In this sense, Campello et al. (2011) perform an interesting work on the real and financial implications of corporate hedging, identifying the mechanism through which the hedging with derivatives affects the corporate outcomes. It is the first study that investigates simultaneously the impact of hedging on the cost of debt, the likelihood of capital expenditures restrictions and investment. The results provide new insights into how hedging affects firm market value by the reduction of interest spreads and a decrease of capital expenditure restrictions, which allows hedger firms to invest more. In turn, Allayannis et al. (2012) in their study attempt to relate foreign currency derivatives, firm value and corporate governance. They "find strong evidence that the use of currency derivatives for firms that have strong internal firm-level or external country-level governance is associated with a significant value premium". Actually, the corporate governance is a particular factor that became to be widespread in recent years as well as their connection with hedging derivatives. For instance, Ugur Lel (2012), using a sample of firms from 30 countries examines the effects of the strength of governance on the likelihood to engage in foreign exchange hedge with derivatives. The conclusions demonstrate that strongly governed firms tend to resort to derivatives to hedge the foreign currency risk while the "weakly governed firms appears to use derivatives for managerial reasons". On the other view, Pérez-Gonzalez and Yun (2013) explore the impact of financial innovation. Thus, they analyze the weather derivatives with a data of U.S.

energy firms and show that its use affects positively valuation, investments and financing decisions.

As evidenced by the previous literature, the hedging activities using derivatives are being scrutinized and explored in many different ways, which highlights the relevance of their current key role, both in management and financial markets. An example is the introduction of other variables such as corporate governance or financial innovation on the research about hedging derivatives. In addition, although the trend points to a positive impact on value of the derivatives use as hedging instruments, the results of the empirical studies remain mixed. While studies such as Allayannis and Weston (2001), Carter et al. (2006), Rossi Junior and Laham (2008) and Chaudhry et al. (2014) present positive influences of hedging activities, Jin and Jorion (2004) and Bartram (2011), for instance, found non-significant impacts of hedging derivatives on firm' value. These mixed results show the needs for more research on this issue and are a motto for us to develop a study on this subject, as complete as possible, to contribute positive and significantly to the literature.

To build our study and develop a comprehensive work, we follow, more or less closely, the examples of literature mentioned above. We address, directly, the question of whether the use of derivatives affects firm market value. Particularly, we examine, as in the examples of broad analyses (Bartram et al. (2011) or Ahmed et al. (2013)) the derivatives use to hedge interest rate exposure and foreign exchange risk exposure in a sample that comprises firms from a wide range of industries[7].

[7] Some particular industries were excluded from the sample. See Data section (pag. 14).

3. Hypotheses Construction

After a brief presentation of some of the most relevant and recent developments in the hedging literature it is time to formulate our hypothesis, based, as it should be, on the previous theoretical and empirical studies.

The corporate hedging may be justified by the market imperfections that permit the relaxing of Modigliani and Miller (1958) theorems. However, while some theories attribute benefits to corporate hedge others consider that risk management should not affect market values (Jin and Jorion, 2006). The first group of theories comprises motivations based on the shareholders' value maximization through the reduction of the cash flows volatility. To concretize this aim the literature suggests three main guide lines of explanation: hedging practices minimize the impacts associated with financial distress and reduce the bankruptcy costs (Mayers and Smith, 1982 and Smith and Stulz, 1985); hedging has associated tax incentives. Hedgers can smooth taxable income and consequently can reduce the value of tax liabilities (Smith and Stulz, 1985)[8]; hedging mitigates the under-investment problem allowing firms to ensure the sufficient internal funds to perform profitable investments through reduction of funds variability (Froot et al., 1993). On the other hand, the second group of theories suggests that hedging strategies are a way for managers to maximize their own utility functions, since hedge their risk on their own account is more costly than hedge through the firm (Smith and Stulz, 1985). In the situations where the hedging motivation is that previous explained, the market value will be not affected positively (Jin and Jorion, 2006).

The main purpose of current study is addressing the question of whether the use of derivatives affects firm market value. We pretend to develop a comprehensive and extensive work, and in this sense we follow Bartram et al. (2011) and Ahmed et al. (2013) and build a research based on distinct risk exposure – interest rate risk and foreign exchange rate risk. However, contrary to the common practices on previous works, including the two works aforementioned, we make use of continuous variables to capture the hedge activities (using the notional values of derivatives, obtained from the annual

[8] The motivation associated with corporate tax implies the existence of a convex tax function.

reports). Actually, most of the studies employ, generally, a binary variable indicating the use of derivatives or not.

Notwithstanding the theory encompasses the possibility that hedging hasn't impact on value, we expect a positive relation between these two variables (value and hedge). This assumption is based on the empirical works that tend to present a positive impact of hedging practices. The first two hypotheses are set out below and correspond to the relation among interest rate derivatives and value (H1) and also foreign exchange rate derivatives and value (H2).

H1: The interest rate hedge with derivatives has a positive impact on firm market value;

H2: The foreign exchange rate hedge with derivatives has a positive impact on firm market value;

Thereafter, we pretend to put into evidence the specific derivative used on the hedging strategy. In this sense, we follow closely Ahmed et al. (2013) and consider separately forward, options and swap contracts, associated to each type of risk exposure. The procedure allow us to realize whether the employ of diversified derivatives produce different outcomes, face to a particular risk exposure. In other words, we study the effectiveness of each derivative in face to each risk exposure and we suppose that this effectiveness differs for each contract (i.e. swap contracts and forward contracts produce different outcomes face to the interest rate risk hedge). This third hypothesis is indicated below (H3).

H3: The type of derivative contracts used doesn't matter on the relation between hedge and firm market value.

To discuss these three hypotheses we perform a set of tests, first in a univariate perspective and then in a multivariate analysis. The univariate tests are a bottom-line to explore these questions related to hedging and its impact on value and the multivariate tests will allow us to conclude on the raised hypotheses. To increase the robustness of these conclusions on the hypotheses postulated here, it will be used two different estimation methods – OLS and 2SLS (the econometric methods will be discussed latter, on the methodology section).

4. Data

The data set used in this research covers non-financial firms listed in FTSE-350 Index (the largest 350 companies by capitalization listed on the London Stock Exchange) for the time period of 2005 to 2013.

Since the study analyses solely the hedging strategies, all the financial firms (Two-Digits US Standard Industrial Classification (SIC) Codes 60-67) were excluded from the sample. In fact, the usage of derivatives by financial industry is likely to have different purposes than non-financial firms, namely speculative or trading purposes. Mining, gas and electricity firms are also excluded (Two-Digits US SIC Codes 10-14 and 49), given that these sectors are particularly exposed to commodity price risk, a type of risk not considered in this work[9]. The wholesale trade (Two-Digits US SIC 50 and 51 Codes) and public administration sectors (Two-Digits US SIC 91 to 99 Codes) had not sufficient observations (only 13 firms in both sectors) and therefore these industries were excluded from the sample for formal and econometric raisons.

In this respect, to the initial sample of 350 firms we deduct those that operate in sectors mentioned above and firms with unavailable financial or derivative data, resulting in a final sample with 130 companies. If we take in account the nine years of data, the total observations reach the number of 1170.

To clarify, Table 1 illustrates the sample construction, mainly, develop the exclusions applied.

[9] By contrast to the foreign exchange risk and the interest rate risk, the hedge of commodity price risk is associated to a specific set of industries such as oil and gas producers or distributers or mining explorers. Due to the concentration of hedging of commodity price in a reduced number of sectors, these hedging practices will not be considered in the analysis. The most common procedure in literature is examining this particular risk exposure isolate using a sample of a singular industry.

Table 1: Sample Construction

The table 1 shows the process of sample construction. From the initial sample comprising all firms listed on an index to the final sample used on the analysis. All the exclusions applied are individually mentioned.

Initial Sample: Firms listed on FTSE-350
Exclusions:
- Financial Firms (two-digit SIC codes 60-67)
- Gas and Electricity (two-digit SIC code 49)
- Mining Firms (two-digit SIC codes 10-14)
- Firms with unavailable derivatives information on the annual reports or financial information on databases
- Firms from sectors with no sufficient observations (Public Administration (two-digit SIC codes 91-99) and Wholesale Trade (two-digit SIC codes 50-51))
Final Sample: 130 Firms

The financial and accounting data on these 130 firms were obtained from *Bureau Van Dijk Amadeus Database*. The exception was dividend info, which was not available on *Amadeus Database* for the most companies of the sample and thus, it was collected from another source, *Thomson Reuters Datastream*. To ensure the correct match between these two databases and to avoid criticism associated with the use of various sources, it was used the universal Exchange Code to identify the firm.[10]

Additionally, the derivatives information was hand-collect from companies' annual reports[11]. This manual process implies locate within the report information about the type of derivatives used with hedge purposes, the type of risks hedged and further its gross notional value. Note that the notional values associated to the derivative contracts was manually collected, to build hedging variable richer in information and more accurate

[10] To a robustness check we compare, for each firm, the total assets in the two databases. Since the value was the same or similar we ensured that we were analyzing the same company.

[11] The annual reports were obtained from companies' official sites or from the site "Northcote" *(http://www.northcote.co.uk/)*, that comprises annual and intern reports of UK listed firms.

than dummies used commonly in literature (for example, Ahmed et al.2013, Marami and Dubois, 2013 and Chandhry et al. 2014, use only a dummy variable).

Apart from data on derivatives, it was collected manually the variables related to the internationalization of the company, namely the existence of foreign currency debt, the total foreign sales and the total of foreign assets (assets held in a foreign country). These three variables will be used as instruments within instrumental variables approach, which will be discussed later.

To simplify it was applied a keyword system to easily localize the information of interest. If a keyword "derivatives", "hedge", "risk management", "swap", "financial instruments", "notional", "forward contract", "future contract" or "option contract" is found the surrounding notes are explored and the variables are manually created. If the program doesn't find results for the keywords we assume, as in prior studies, that firm is a non-hedger. The same happens when firms explicitly or implicitly disclose on reports they don't hedge their risks with derivatives.

The time period choice is logically justified by the adoption of new rules on the accounting standards in the year 2005. In fact, before 2005 the availability of hedging and derivatives information was a critical problem in some countries as stated by Ugur Lel, (2012) "A study of non-US firm's hedging activities is challenging because the disclosure of information on the use of derivatives is voluntary in most countries". Recently, according to IAS 39, firms have to disclose separately the financial instruments related to hedging activities, what allow us to access this information more clearly since 2005. This update was an important pillar in accounting standards and keep up with the increase of importance and fast development of financial derivatives as hedging instruments.

5. Methodology

To scrutinize the role of hedging derivatives on the firm market value, if it exists, we run a complete set of regressions. These regressions comprise initially the types of risks considered (FX risk, IR risk) and thereafter the type of derivative contracts used (swaps, forward, option)[12].

The main variables included in the model are explained below.

5.1 Variables

I) Measurement of firm value

Since we aim to understand the behavior of firm's market value regarding the hedging policies using derivatives, our dependent variable should capture exactly the market value of the firm. In this sense we follow the main studies on the subject (Allayannis and Weston, 2001, Mackay and Moeller, 2007, Rossi Júnior and Laham, 2008, Bartram et al., 2011 and Allayannis et al., 2012) and choose an adjusted Tobin's Q measurement as a proxy of firm value.

Tobin's Q is defined as the ratio of the firm market value to the replacement cost of assets. However, the availability data implies that, in practice, the majority of authors use a simple approximation: Tobin's Q equal to book value of total assets less book value of equity plus market value of the equity, scaled by the book value of total assets (Rossi Junior and Laham, 2008, Ahmed et al., 2013 and Marami and Dubois, 2013). To prevent possible econometric problems generated by the skewed distributions of Tobin's Q in the sample it is used in the regressions their natural logarithm (procedure commonly applied on previous literature to promote more symmetric distributions)[13].

[12] Note that future contracts are inexistent in this sample due the fact that over the time period analysis, no firms disclose information about the engagement in future contracts to hedge foreign exchange rate or interest rate risk. In this way they are not comprised in this work.

[13] See, for instance, Allayannis and Weston (2001), Rossi Júnior and Laham (2008), Allayannis et al. (2012) and Ahmed et al. (2013).

II) Measurement of hedging derivatives

To capture the hedging derivatives, the commonest procedure in literature is construct a simple dummy variable separating hedgers and non-hedgers such as Fauver and Naranjo (2010), Allayannis et al. (2012), Ahmed et al. (2013) and Pérez-González and Yun. (2013) studies. The measurement of the hedging through a binary variable is associated with several advantages, for example, it is easily constructed, the gathering of information is quickly and the fundamental data is generally available. However, a simple dummy is less informative and less accurate than a continuous variable, which not only separate hedgers and non-hedgers but also catches the extent of derivatives use. Although the creation process of a continuous variable is time consuming, we choose to enter it on this study due to it higher informative power. Another reason that explains this choice is the possibility to compare our results using a continuous variable with the results of similar studies that only use a dummy variable and therefore realize whether the different definitions of variables produces different outcomes[14]. Authors such as Rossi Júnior and Laham (2008) and Campello et al. (2011) applied similar continuous variables on their works but do not isolate the type of contracts.

The hand-process to obtain the derivatives information leads us to construct a set of indicative variables, more or less detailed. In a less degree of detail we develop two variables, (1) Foreign Exchange Risk Derivatives (*FXD*) and (2) Interest Rate Risk Derivatives (*IRD*).

FXD is defined, for each firm i, as the ratio of total notional value of derivatives used to hedge foreign exchange rate exposure to the total assets. Similarly, *IRD* is the notional value of interest rate derivatives used with hedging purposes normalized by the total assets.[15]

[14] In a robustness test, the regressions are replicated using a simple dummy variable that separate hedger and non-hedger firms. Despite this modification on the variables definition the main findings remain similar, although, as mentioned on the text, we believe in a greater informative power of the variables based on the notional values and firm assets. For reasons of space, the regressions mentioned above are not illustrated in the study.

[15] The notional value is irrespective of the direction of the market positions (see Campello et al., 2011).

Then, we detailed the variables to a more comprehensive analysis. In this sense, a new set of variables is developed based in the two aspects, the type of risk hedged (interest rate risk and foreign exchange risk) and the type of contracts used (swaps, forwards and options). The foreign exchange risk hedge is visible on the variables *FXFW, FXS* and *FXO,* respectively FX hedge with forward contracts, FX hedge with swaps and FX hedge with option contracts. The interest rate risk hedge is patent on the variables *IRS* and *IRO,* corresponding to IR hedge with swaps and IR hedge with option contracts.

Their formal definitions follow the same logic of *FXD* and *IRD* variables. *FXFW* is the notional value of forward contracts used to hedge the foreign exchange risk normalized by the total assets; *FXS* is the notional value of swap contracts used to hedge the foreign exchange risk normalized by the total assets; *FXO* is the notional value of option contracts used to hedge the foreign exchange risk normalized by the total assets; *IRS* is the notional value of swap contracts used to hedge the interest rate risk normalized by the total assets; *IRO* is the notional value of option contracts used to hedge the interest rate risk normalized by the total assets.

III) Control variables

There is a set of variables that can impact the value of the firm, apart from the hedging practices. Consequently, to make consistent inferences on the subject, it is necessary to consider all of the relevant variables in the research.

Following the previous literature the control variables that we include in our empirical model are:

(1) **Leverage:** the literature shows that company's capital structure has some impact on its value. However this relation is ambiguous, with negative and positive impacts at the same time. The theory claims that the existence of tax shields on payments of interest have a positive effect on value but on the other hand if we consider that a higher level of leverage leads a higher likelihood to bankruptcy (implying the payment of bankruptcy costs) the impact of leverage on firm's value will be negative (Rossi Junior and Laham, 2008). In previous empirical studies, Allayannis and Weston (2001) and Allayannis et al. (2012) found a negative relation between leverage and firm value while Jin and Jorion (2006) and Bartram

et al. (2011) found a positive and significant impact of leverage on firm value. Based on these mixed theoretical and empirical arguments, it is not expected a particular signal to the coefficient on the multivariate regression.

To capture the capital structure of a firm we follow Jin and Jorion (2006), Rossi Júnior and Laham (2008) and Lin and Chang (2009)[16] using the leverage ratio defined by the long term-debt to total assets.

Besides, Smith and Stulz (1985) argue that leverage could be a proxy for financial distress. Firms with greater leverage ratios are more likely to hedge, showing that capital structure also has some influence on the risk management policies.

(2) **Size:** the firm size has been identified in previous literature as a factor related with its value.[17] Although the signal of this relation remains ambiguous (Jin and Jorion, 2006) we include the log of total assets in our model as a proxy of firm size (Allayannis and weston, 2001, Jin and Jorion, 2006, Allayannis et al., 2012, Pérez-González and Yun, 2013 and Ahmed et al. 2013).

Further, the size affects the likelihood to use derivatives as hedge instruments. There are strong empirical evidences that bigger firms are more prone to engage in hedging strategies than the small ones due to the fixed costs of hedging and scale economies.

(3) **Dividends:** in Allayannis and Weston (2001) and Jin and Jorion (2006) the dividends are a proxy for the firms' access to financial markets. "If a firm paid a dividend, it is less likely to be capital constrained and may thus have a lower Q" (Allayannis and Weston, 2001) and according to this reasoning the impact of profit distributions are negative. From another point of view, dividends can give significant information about the future profitability and in this sense be a positive

[16] Some authors opt to use different definitions of leverage, namely the total debt scaled by total assets such as Bartram et al. (2011) and Ahmed et al. (2013).

[17] The reasons to this relation could be explained through profitability (Mueller, 1987) and efficiency (Peltzman, 1977) theorems.

signal about the firms' management (Jin and Jorion, 2006 and Rossi Junior and Laham, 2008).

We use a dummy variable equal one if the company pays dividends and zero otherwise.

(4) **Investment growth/Investment opportunities:** the previous literature on this subject includes in the models a control variable that captures the future investment growth. They suggest that the firms' value may be affected positively by these growth opportunities. The current research follows the majority of authors (Allayannis and Weston, 2001, Rossi Junior and Laham, 2008, Allayannis et al., 2012 and Ahmed et al., 2013) and adopts Capital Expenditures and Research and Development (R&D) as proxies to investment opportunities. Capital expenditures are defined as the ratio between the total of capital expenditures to total sales and the R&D is the total R&D expenses scaled by the total sales. Unfortunately the information about R&D expenses was not available for a large part of our sample. To mitigate the missing values problems and the subjacent reduction of sample we embrace a mechanism similar to Allayannis and Weston (2001) where it is assumed that the missing values are zero.

We expect a positive relation among firm value and these two variables, Capital expenditures and R&D.

(5) **Liquidity:** as in Rossi Junior and Laham (2008) we control for the liquidity differences including a variable defined by the ratio of current assets to current liabilities. The excess of liquidity motivates companies to develop projects with negative NPV (Net present value) which does not increase the shareholder wealth (Jensen, 1986). We expect a negative signal in this variable.

(6) **Profitability:** the profitable firms are more likely to be trade at a premium, than the less profitable firms and in this sense their firm market values are higher (Allayannis and Weston, 2001, Jin and Jorion, 2006, Rossi Junior and Laham, 2008). To control for this firm characteristic it is used the Return on Assets (ROA)

calculated as the ratio of firm's net income to total assets. The theoretical and empirical evidences lead us to expect a positive coefficient for this variable.

(7) **Multinational diversification:** the theory postulates that firms operating in several geographical locations tend to present higher market values and thus the geographic diversification increase firms' value. Rossi Junior and Laham (2008) and Ahmed et al. (2013) found a positive relation between this variable and the QTobin and following this results we expect a positive coefficient also.
Further, Ahmed et al. suggest that the multinational diversification impact the hedging policies, being the companies geographically diversified more likely to use hedging derivatives, namely foreign exchange derivatives.
To measure the geographic diversification we use a dummy variable equal one if the firm presents foreign sales (proxy to business abroad) and zero otherwise.

(8) **Industry diversification:** the effect of industrial diversification on the firm value is ambiguous. Some arguments states that sectoral diversity add value and other arguments consider that industry diversification is value destroying (Allayannis and Weston, 2001). However, the empirical studies such as Allayannis and Weston (2001), Rossi Junior and Laham (2008), Ahmedet al. (2013) evidence that diversification is negatively related to firm value. Additionally, Ahmed et al. assert that "firms with more diversified business are more likely to hedge".
We calculate this variable as a dummy equal one if the firm operate in more than one sector (four-digit US SIC-codes) and zero otherwise.[18]

(9) **Time effects:** we control for the time-fixed effects. Naturally, each year has some unique specificities and a macroeconomic context that may affect the firm value (Rossi Junior and Laham, 2008).

[18] To obtain the industry diversification variable we collected information about primary US Sic code and secondary US Sic-codes, available on the *Amadeus Datastream*. If the secondary Sic-code exists and is different from the primary one, it is considered that the firm is industrial diversified.

(10) **Industry effects:** we also control for the industry-fixed effects including a dummy variable per sector based on one-digit Standard Industrial Classification (SIC) codes. Different industries may be associated to different QTobin's (justified by different levels of fixed assets, for example) and further the growth opportunities can be different across industries (Pramborg, 2004). In this regard, to control for industry effects is truly relevant in this study and a standard practice in previous similar researches.

5.2 Empirical Models

To achieve the goals established for this work, the variables mentioned and explained above are combined, resulting in a set of empirical models. Since the main aim of these tests is understand the behavior of the firm market value face to hedging activities with derivatives, our dependent variable is, irrefragably, a firm value proxy (QTobin) and the key variables are proxies that capture the derivatives use and, as far as possible, their use intensity.

The first regression model is stated below, where *t* refers to time and *i* to each firm:

$$(A) \quad QTobin_{,i,t} = \partial + \Theta_1 FXD_{i,t} + \Theta_2 IRD_{i,t} + \rho X_{i,t} + \varepsilon_{i,t}$$

∂ represents the constant term and Θ_1 and Θ_2 represent our target coefficients, respectively, *FX* risk derivatives coefficient and IR risk derivatives coefficient. In turn, *X* expresses all control variables explained in the preceding section – *Leverage, Total Assets, Dividend Dummy, R&D, Capital Expenditures, ROA, Liquidity, Multinational diversification* and *Industry diversification*. The regression error term is represented by epsilon (ε). This model permits us to test the hypothesis H1 and H2, while the follow models B and C permit test the remaining hypothesis, H3.

$$(B) \quad QTobin_{i,t} = \partial + \Theta_1 FXFW_{i,t} + \Theta_2 FXS_{i,t} + \Theta_3 FXO_{i,t} + \rho X_{i,t} + \varepsilon_{i,t}$$

$$(C) \quad QTobin_{i,t} = \partial + \Theta_1 IRS_{i,t} + \Theta_2 IRO_{i,t} + \rho X_{i,t} + \varepsilon_{i,t}$$

The regressions B and C consider the different contracts employed. Regression B analyzes the foreign exchange risk hedges, studying the impact of forward contracts (*FXFW*), swaps (*FXS*) and options (*FXO*). Regression C has the focus on the interest rate risk, studying separately the swaps (*IRS*) and option contracts (*IRO*).

To estimate the effects of hedging it is used primarily an OLS method and then, to solidify the analysis and alleviate some endogeneity problem, it is employed a two-stage least squares instrumental variables approach. Additionally, we control for time and industry fixed-effects in both methods of estimation. Since time affects the dependent variable (firm value), we control for this impact performing a time fixed-effects. Similarly, the use of derivatives is different across sector and different sectors have associated different QTobins. In this sense, it is also important to control for this effect of industry on firm value and hence it is included a dummy variable for each industry sector (based on one-digit SIC codes) in all regression estimated by OLS method or two-stage least squares.

Previous researches as Rossi Junior and Laham (2008), Allayannis et al. (2012), Ahmed et al. (2013) and Marami and Dubois (2013) also control their models to fixed effects of time and industry.

6. Empirical Results

6.1 Descriptive statistics and univariate analysis

Within our sample, described in the previous section, only 17 firms out of the 130 don't use any type of derivatives to hedge their risk, which represents only 13% of our sample. This means that 87% of companies in this sample rely on derivatives to manage the risk exposure. This number highlights the importance that companies, at least the type of companies included in our sample, attach to derivatives as a means to reduce or eliminate their risks. In addition, 86 of the 130 firms used derivatives to hedge interest rate risk (66%) and 83 hedged their foreign exchange risk in the period (64%). The proportions of derivatives' use as hedging instruments that are evidenced in this work are similar to Ahmed et al. (2013), who examines a sample of UK non-financial firms for the years 2005-2012 (68.1% of companies use FX derivatives and 63.8% of them use IR derivatives). However, these numbers are substantially higher than in some previous studies, mainly older works such as Campello et al. (2011), which cover a sample of firms during the period of 1996 to 2002 (35.6% of firms use IR derivatives and 27.3% use FX derivatives). These inflated results are an apparent reflex of the increased popularity of derivatives to manage the corporate risk exposure in the last decades.

The Table 2 illustrates the derivatives use by non-financial firms (Panel A) and also the summary statistics to the hedging variables (Panel B).

Table 2: Derivatives Usage and Derivatives Summary Statistics

The table shows the most relevant information about sample, in respect to derivatives. The Panel A is intended to exhibit the number of firms that engage in hedging strategies using derivatives, at least one time, during the sample period (2005-2013). The type of risk hedged (Interest Rate (IR), Foreign Exchange Rate (FX) or both) is represented in the first column and the second column presents the type of derivative used (Forward, Swap, Option or all of them). The last column illustrates the number of firms that use that derivative to hedge that specific risk exposure (for example, 84 firms use swap contracts to hedge the interest rate risk). Additionally, the percentage of firms using derivatives face to the total firms in the sample is also shown on the third column. The Panel B shows the means, medians, maximum value, standard deviation and the total number of observations used to perform the statistics, in respect to the derivative variables (Interest Rate Derivatives (IRD), Interest Rate Swaps (IRS), Interest Rate Options (IRO), Foreign Exchange Rate Derivatives (FXD), Foreign Exchange Rate Forwards (FXFW), Foreign Exchange Rate Swaps (FXS) and Foreign Exchange Rate Option (FXO)). The table presents statistics for the total notional values in thousands of pounds (first line) and also for the ratio of notional values to total assets (second line).

Panel A: Derivatives Usage

Risk Exposure	Derivatives	Firms
IR and/or FX	All	113
		87%
IR	All	86
		66%
IR	Forward	0
		0%
IR	Swap	84
		65%
IR	Option	12
		9.2%
FX	All	83
		64%
FX	Forward	75
		58%
FX	Swap	13
		10%
FX	Option	6
		4.6%

Panel B: Hedging Summary Statistics

Notional Values - thousands of pounds							
	IRD	**IRO**	**IRS**	**FXD**	**FXS**	**FXO**	**FXFW**
Mean	508275	5153	503547	412379	7026	3123	405261
Median	51000	0	51000	8216	0	0	0
Maximum	19547000	579000	19547000	30553783	1009000	344540	30553783
Std. Dev.	158828	37566	1587459	2100820	54215	22772	2109390
Observations	1041	1053	1040	1043	1050	1053	1035
Notional Value/Total Assets							
	IRD	**IRO**	**IRS**	**FXD**	**FXS**	**FXO**	**FXFW**
Mean	0,1052	0,0028	0,1025	0,0680	0,0035	0,0029	0,0619
Median	0,0387	0,0000	0,0371	0,0064	0,0000	0,0000	0,0003
Maximum	1,2444	0,2702	1,2444	1,2331	0,4499	0,4352	1,2331
Std. Dev.	0,1610	0,0194	0,1580	0,1285	0,0230	0,0226	0,1247
Observations	1023	1032	1022	1022	1029	1032	1015

Panel A demonstrates that the popularity of some contracts depends on the type of risk hedged. The patterns that emerge from the data analysis show that the most common derivative to hedge the foreign exchange risk is the forward contract (58% of companies), being the swaps less used (10%) and options used just residually (4.6%). In turn, to hedge the interest rate risk the most used derivative is clearly the swap (65%) whereas the option contracts represent only 9% of total sample. Once again, the standards that we found in this study regarding the use of each specific derivative are consistent with the previous empirical works.[19] Interest rate futures, interest rate forward and foreign exchange rate futures are not present on table inasmuch as in this sample their values are null. In other words, firms in this period didn't made use of these particular derivatives.

The summary statistics of hedging variables are reported on Panel B. The notional amounts associated to the hedging derivatives are expressive and in some cases these values have relevance on the balance sheets of the companies (considering the percentage of notional amount to assets that will be mentioned later). In respect to the interest rate

[19] See, for instance, Ahmed et al. (2013).

derivatives (*IRD*) the mean of its notional value is an impressive value of 508 million pounds. The IR swap contracts have a similar mean value (503 million pounds), while, on contrary, the mean value associated to the IR option contracts is only 5 million pound. In case of foreign exchange rate risk management, the mean of *FXD* notional value reaches the 412 million pounds while the notional values of *FXFW* are in average about 405 millions. By contrast, the means of notional values for the *FXS* and *FXO* do not exceed the 7 and 3 million pounds respectively, being contracts less popular on corporate hedging.

If we consider the continuous variables the results are equivalent since the ratio between gross notional values of hedging derivatives and total assets presents considerable values. The amount of interest rate derivatives used by a firm represents on average 10.5% of its total assets whereas the foreign exchange derivatives represent about 6.8 %. Detailing the contracts, the ratios are respectively 10%, 0.3% for interest rate swaps and interest rate options and further 6.2%, 0.3% and 0.35% for foreign exchange forward, options and swap contracts respectively.

Further, adding the time factor to the analysis, we realize that the firms' behavior face to the hedging with derivatives has been changing over the period of analysis. Actually, if we consider the hedging intensity (notional values scaled by assets) over the years 2005-2013 the interest rate derivatives and the foreign exchange rate derivatives present a trend more or less clear. The interest rate derivatives have a positive trend until 2009, increasing from 11% of total assets to the highest value observed of 13% of total assets. After this increase, the use intensity drops the remaining years to a ratio of notional values to assets of 7%. In turn, the foreign exchange derivatives exhibits a growth tendency but not constant. The hedging ratio doubles between 2005 and 2008 from 4% to 8%, and then presents a slight decrease until 2009 but the positive trend remain in the following years. In respect to other variables, while *IRS* and *FXFW* present behaviors similar to *IRD* and *FXD* respectively, the use of *FXS, FXO* and *IRO* are reasonably stable and with lower ratios associated.

The positive conduct observed in foreign exchange derivatives is consistent with Ahmed et al. However, Ahmed et al. found that the *IRD*' use has a positive trend during all of the years, as well, contrary to our findings. A reasonable answer to this difference is that,

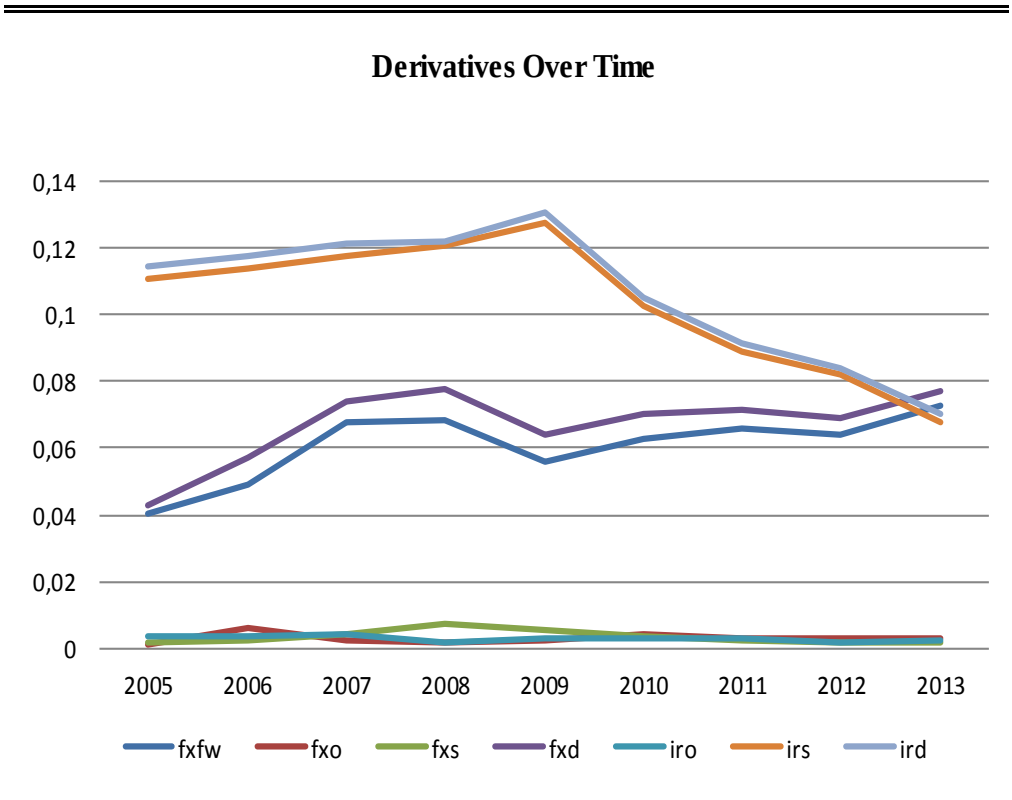
even the sample cover in the two studies a universe of UK non-financial firms, in Ahmed et al. are only considered the derivative's use as a dummy variable, while we take in account the ratio of notional value to assets. In this sense, the number of firms that hedge their IR risks with derivatives can increase over time but the percentage of notional values hedged could have another trend (In this case, the intensity increases initially but decreases after the year 2009).

To a robustness check, it is observed the IR hedgers by year and found a growing number of hedger firms, increasing from 46 firms in 2005 to 58 in 2013. This analysis, similar to Ahmed et al. produces results consistent with this previous study.

These interesting findings are illustrated on the following graph:

Graph 1: Derivatives Intensity Over Time

The Graph 1 reports the ratio between notional value and total assets for the foreign exchange rate derivatives (FXD) and interest rate derivatives (IRD). Additionally, are also illustrated the ratios for each type of contract (Swap, forward and options) and for each type of risk hedged (IR and FX risk) resulting in five variables (FXFW, FXS, FXO, IRS and IRO). The results are reported individually per year for the sample period between 2005 and 2013.



The time series graph evidences another interesting detail concerning to the financial crisis. Through the graph we can see that the major variations on the derivatives' use intensity were in years 2008 and 2009. As we know, 2008 and 2009 are associated to a powerful financial crisis, which allow us to deduce that this macroeconomic phenomenon had some impact on hedging mechanisms.

Although not in a massive way, some previous researches focus also on the crisis effects in hedging strategies. Ahmed et al. (2013) found that "there is no evidence that 2008-2009 financial crisis has led to significant changes in firms' behavior regarding the use of derivatives for hedging". On the other hand, Bartram et al. (2011) focus on 2001 economic decline and stated that hedging is undoubtedly more important during crisis periods.

Additionally, if we split the sample between companies with and without business abroad (dummy variable *Geographic Diversification* equal 1) the results of derivatives' use are more expressive, mainly for the foreign exchange rate risk derivatives, as expected. The mean of *FXD* increased from 6.8% in full sample to 9.2% in the sub-sample with only geographic diversified firms. In the sub-sample of companies without business abroad the intensity of FX hedge are about 2.3%. This small value of FX hedgers is easily explained by the non-exposure or less risk exposure of the company to the foreign exchange rate.

Table 3 summarizes the statistics of some explanatory variables and firms' characteristics (Panel A) and the pairwise correlation matrix (Panel B)

Table 3: Summary Statistics and Correlation Matrix

The table 3 presents the summary statistics of main firms' characteristics (Panel A) and also the matrix of Pearson Correlations (Panel B). In Panel A are illustrated the mean, median and standard deviation values as well as the total number of observation used in the statistic tests. The variables analyzed are ROA (Return on Assets), EBIT (Earnings Before Interest and Tax), Leverage, Liquidity, Ind_Div. (Industrial Diversification), Mult_Div. (Multinational Diversification), Assets (Total Assets), Div_D (Dividend Dummy) and QTobin. The Panel B shows the Pearson Correlations among variables. The correlations are obtained using a balanced sample with a total number of 571 observations.

Panel A: Summary Statistics

	ROA	Cap.Exp.	EBIT	Leverage	Liquidity	Ind_Div.	Mult_Div.	Assets	Div_D	QTobin
Mean	0,0843	0,0570	430943,0	0,2038	1,7930	0,5461	0,70300	3863717,0	0,8896	0,5820
Median	0,0703	0,0389	100500,0	0,1940	1,2760	1,0000	1,00000	1111050,0	1,0000	0,5853
Std.Dev	10,0620	6,5710	1089241,0	0,1810	2,5640	0,4980	0,45700	7555732,0	0,3130	0,2250
Obs.	1112	1140	1113	1094	1105	1170	963	1116	1114	1065

Panel B: Pairwise Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Capital Expenditures	1,0000															
2 Dividend_Dummy	0,1334	1,0000														
3 Foreign Revenue	-0,1566	0,0881	1,0000													
4 Foreign Currency Debt	-0,0437	0,1906	0,4486	1,0000												
5 FXD	-0,0030	0,0117	0,1854	0,1987	1,0000											
6 IRD	0,0203	0,1306	-0,0250	0,0212	-0,1802	1,0000										
7 Industrial_Div	0,0034	0,0915	0,1720	-0,0050	-0,0060	0,0405	1,0000									
8 Interest paid	0,1379	0,0374	-0,0947	-0,1437	-0,0999	0,1626	0,1790	1,0000								
9 Leverage	0,1366	0,1183	-0,0686	0,0229	-0,2045	0,5589	0,0487	0,4005	1,0000							
10 Liquidity	-0,1015	-0,1123	0,0021	0,0709	0,0545	-0,1055	-0,0404	0,1887	-0,0492	1,0000						
11 Maturity	0,1619	0,1591	-0,0532	0,0008	-0,2685	0,4528	0,0996	0,5763	0,8825	-0,0291	1,0000					
12 Multinational_Div	-0,1355	0,1923	0,7126	0,5450	0,2246	-0,0246	0,0510	-0,1802	-0,0776	-0,0148	-0,1264	1,0000				
13 R&D	-0,2173	-0,1852	0,2718	0,1593	0,2233	-0,2343	-0,0504	-0,1467	-0,3422	0,1356	-0,3565	0,2787	1,0000			
14 ROA	0,1203	0,1102	0,0258	-0,0812	0,2384	-0,1382	-0,0146	-0,2270	-0,1818	-0,0529	-0,2333	0,0119	0,0114	1,0000		
15 Qtobin_log	0,0405	0,1297	-0,1180	-0,0280	-0,0765	0,3659	-0,0062	-0,0206	0,5582	-0,2764	0,2971	-0,0389	-0,4843	-0,0195	1,0000	
16 Total Assets	-0,1543	0,1172	0,0858	0,2051	-0,0796	0,2774	0,0714	0,1976	0,3507	-0,1076	0,3573	0,1570	-0,1164	-0,2193	0,2619	1,0000

In broad terms, through the observation of Panel A we get a sense about the firms' features, mainly financial characteristics. It should be noted that the firms included on

our sample are relatively larger, with an average (median) size of 3.8 billion pounds (1.1 billion pounds) and an EBIT mean (median) of 430 million pounds (100 million pounds).[20] Further, 70% of firms in this sample have business abroad (*Geographic Diversification* equal 1), 55% operate in several industries (*Industry Diversification* equal 1) and about 89% of firms proceeds to a dividend distributions. The return on assets mean (median) is 8.4% (7%) while leverage is about 20%. We should pay attention also to the *Tobins'Q*, the measure of market value and the dependent variable in our model. The average of *Tobins'Q* is 0.582 and despite being a relatively low value, it is in line with Ahmed et al. who also studied the British non-financial firms.

In turn, the matrix correlations illustrated in Panel B, show the correlations between dependent variables and explanatory variables and among explanatory variables. The correlation coefficients among the various independent variables included in our model are not high (except *Leverage* and *IRD* (0.56) all other independent variables correlations assume values less than |0.4|), which indicates the non-existence of collinearity issues. The correlation values between the dependent variable (*Tobins'Q*) and some of the explanatory variables are reasonable strong, evidencing the role of those variables on firm market value and bringing first evidence about the signal of their relations. The instrumental variables used on the two-stage least squares are also included on the matrix and will be discussed on the next section.

An alternative way to increase our knowledge about the impact of hedging derivatives on firms' characteristics is compare firms with different policies face the risk management. In this sense the sample was broken into hedger and non-hedger firms and the differences of mean values were calculated for the main variables. Subsequently, to find out the statistical significance of these differences among subsamples a t-test was done, which allow us to make stronger and supported inferences.

The mean values of total assets (size proxy), leverage, EBIT, dividend distribution and QTobin are significantly different between two subsamples. As expected, hedgers firms

[20] Mean values and median values are substantially different, which indicates the existence of some diversity in the type of companies included in the sample. Note also that all of the firms in this sample are listed companies.

are larger, in concordance with argument that more large firms tend to hedge more than small ones (Stulz, 1996, Fauver and Naranjo, 2010 and Fok et al., 1997). Further, the firms on the hedgers group have a greater leverage ratio, a greater EBIT value and are associated to a higher likelihood to distribute dividends. More importantly, the firm value measured by the QTobin is higher for the hedgers firms (significance at 1% level) indicating that the hedging practices using derivatives add value and should be considerate positive for the shareholders' interests and stakeholders as a whole. On the other hand the ROA means are not significantly different among subsamples, which denote the non-impact of hedging on performance. Additional information is presented on Table 4.

Table 4: Hedgers vs. Non-hedgers – Mean Differences

The Table 4 presents the means of the main variables in the subsample of hedger firms and to the non-hedger firms. The first column indicates the variable considered (QTobin, Return on Assets (ROA), Total Assets, Multinational Diversification (Multi_Div), Industrial Diversification (IND_Div), Leverage, Liquidity, Dividends, Capital Expenditures (Cap.Exp.) and EBIT). The second column shows the mean values for the subsamples that comprises only hedging firms and the third one shows the mean values obtained using a subsample of non-hedger firms. The last column presents the difference of means (mean of hedger firms less mean of non-hedger firms). Additionally, in this column are also shown the statistical significances of those distinct means obtained through the t-test. ***, ** and * denote significance at 1%, 5% and 10% level, respectively.

Variable	Mean		Difference
	Hedgers	Non-Hedgers	
Qtobin	0,6163	0,5318	0,0844***
ROA	0,0799	0,0853	-0,5415
Total Assets	5077985	2411397	2666588***
Multi_Div	0,7241	0,5646	0,1595***
Ind_Div	0,5576	0,5180	0,0397
Leverage	0,2563	0,1457	0,1105***
Liquidity	1,6477	1,9073	-0,2595*
Dividend	0,9286	0,8615	0,0670***
Cap.Exp.	0,05336	0,0575	-0,4159
EBIT	573680,3	247085,8	326594,5***

This univariate analysis is a bottom line to explore this topic and gets us a general view of the data. Further, the descriptive statistics and the preliminary tests performed are important tools that help us to shed some lights about our issues. Actually, this first review lead us to state the weight attributed to the hedging derivatives by the non-financial firms and the distinct characteristics among hedgers and non-hedgers, for instance, the market value (QTobin). In the next section the raised hypotheses will be discussed again, but this time in a multivariate perspective, using the results obtained through the two methods of estimation applied – OLS and 2SLS.

6.2. Multivariate Results

The overall results obtained from OLS and 2SLS (Instrumental Variables) estimations bolster the univariate test in respect to the importance attributed to hedging derivatives.

The empirical evidence shows a positive and significant effect of foreign exchange derivatives in firm value, either using OLS method or the two-stage least squares method. In turn, the impact of interest rate derivatives is also positive in both methods of estimations, however the coefficient is only statistically significant in one of them (2SLS). These general findings demonstrate that investors perceive the use of derivatives as corporate hedging instruments and consequently the market reward these firms with an increase of their market values. When the type of contracts is specified the overall results remain in the same lines. However, in respect to some particular contracts, namely the option contracts, the effect on market value becomes insignificant or even negative, which highlight the relevance to taking into account the contracts choice.

After this brief presentation of our main results, they will be discussed minutely, beginning with the analysis of Table 5, where are illustrated the results of OLS estimations. Remember that each OLS regression has been estimated with year fixed effects and industry dummies.

Table 5: OLS Regressions on the Intensity of Derivatives Use and Firm Value

The Table 5 presents the coefficients estimated for the OLS with time fixed effects and industry dummies regressions. The dependent variable is the QTobin, a proxy to the firm market value. Model A reports the regression of foreign exchange rate derivatives (*FXD*) and interest rate derivatives (*IRD)* use (Remember that the variables are defined as the notional value of derivatives to total assets). Model B shows the regression of derivatives use to hedge the interest rate risk, using options (*IRO*) and swaps (*IRS*). Finally, the Model C reports the regression of foreign exchange derivatives, respectively, forward (*FXFW),* swaps (*FXS*) and options (*FXO*). The standard errors are represented in parentheses below each coefficient and the statistical significance are illustrated with the common symbols ***, ** and *, which denotes a significance at the 1% 5% and 10% level, respectively.

	Model A	**Model B**	**Model C**
C	-0,9432	-0,9618	-0,9340
	(-4,2176)***	(-4,3444)***	(-4,2045)***
FXD	0,3569		
	(2,4697)**		
IRD	0,0680		
	(-0,4153)		
FXFW			0,3575
			(2,4364)**
FXS			1,5455
			(2,2321)**
FXO			-2,2011
			(-2,8019)***
IRS		0,1374	
		(-0,8261)	
IRO		-2,6030	
		(-2,3759)**	
Leverage	1,5221	1,5092	1,5696
	(10,6803)***	(10,6816)***	(12,1329)***
Liquidity	-0,0380	-0,0344	-0,0355
	(-3,6345)***	(-3,2889)***	(-3,4213)***
ROA	0,0075	0,0083	0,0071
	(3,5319)***	(4,0164)***	(3,3619)***
Capital Expenditures	-0,0234	-0,0225	-0,0236
	(-6,9111)***	(-6,6388)***	(-7,0314)***
R&D	-0,0163	-0,0148	-0,0136
	(-4,3577)***	(-4,0524)***	(-3,5891)***
Dividend_Dummy	0,2994	0,3068	0,3272
	(4,9188)***	(5,0925)***	(5,4023)***
Multinational_Div	0,0051	0,0202	-0,0155
	(-0,116)	(-0,4832)	(-0,3567)
Industrial_Div	0,0319	0,0289	0,0141
	(-0,8632)	(-0,791)	(-0,3831)
Total Assets	-0,0144	-0,0147	-0,0147
	(-0,9501)	(-0,9803)	(-0,9806)
Year Dummies	YES	YES	YES
Industry Dummies	YES	YES	YES
R-Squared	0,3529	0,3556	0,3654
Adjusted R-Squared	0,3331	0,3361	0,3450
F-statistic	17,7829	18,2603	17,9683
Prob(F-statistic)	0,0000	0,0000	0,0000
Number obs.	774	785	774

Model A evidences simultaneously the impact of the interest rate derivatives and foreign exchange rate derivatives without take in account the type of derivatives used. Both coefficients are positive, what it is a first clue that the use of derivatives with hedging purposes add value and increase the wealth of shareholders.

The coefficient of foreign exchange risk derivatives (*FXD*), one of the most relevant parameters in this study, is positive (0.3569) and statistically significant at 1%. Regardless the type of contracts, the firms that engage in hedging activities with derivatives to reduce the currency exposure tend to present higher market values, being the information about these policies well received among investors. This finding is in agreement with Allayannis and Weston (2001), Rossi Junior and Laham (2008), Lin and Chang (2009), Allayannis et al. (2012) and Ahmed et al. (2013) that also found a significant role of the foreign currency hedging on value.

The other relevant parameter is the interest rate risk derivatives (*IRD*) coefficient. The relation is either positive (coefficient equal to 0.068) illustrating that interest rate hedging may be related to the increase of the firms' value. However, the *IRD* coefficient is not statistically significant, which limits our interpretation about this result. If we attend only on the coefficient signal (although not significant it is a start point to our investigation) we realize that it is in line with existing literature such as Belghitar et al. (2008), Marami and Dubois (2013) and Chandbury et al. (2014) that found as well a positive impact of IR hedge. Contrary, Ahmed et al. (2013) concluded that IR hedging with derivatives performed by non-financial firms is value destroying.

The OLS results lead us to confirm the first hypothesis postulated, H1 about the positive impact of FX derivatives usage but don't support the second hypothesis, H2, due to the statistical insignificance of the IRD coefficient.

Regarding the other explanatory variables or control variables the results presented are, for most of them, aligned with literature. The *Leverage* coefficient is positive and significant (at 1% level) confirming the argument on the tax shields on interest payments in opposite to the bankruptcy costs. This result resembles to Jin and Jorion (2006) and Bartram et al. (2011). As expected, the liquidity has a negative impact on value and the more profitable firms have higher QTobins, in other words, return on assets and firm value are positively correlated.

As Allayannis and Weston (2001) and Allayannis et al. (2012) we obtain a negative and significant (at 1% level) coefficients for the variables *Capital Expenditures* and *R&D*, proxies to growth opportunities. The negative signal is against our expectation, since the theory suggests that the firms' value may be affected positively by these growth opportunities and this theory is supported by the most studies on the subject. This difference face to theoretical and empirical literature may be justified, for instance, by the formal definition of *R&D* that diverges from the majority[21] or it may be a simple outcome of our specific and small sample.

In respect to the variables *Dividend Dummy*, *Multinational Diversification* and *Industrial Diversification*, the coefficients reported in Table 5 assume positive values (nonetheless, *Multinational Diversification* and *Industrial Diversification* coefficients are statistically insignificant). The negative impact of dividends, support the argument that earnings distributions can be understood as signals to the future profitability of the firm (see Jin and Jorion, 2006 and Rossi Junior and Laham, 2008). In turn, while the result for multinational diversification variable is commonly achieved in literature, the positive impact of Industrial Diversification is contrary to the hypothesis that business diversification leads companies to lower market values.[22] Finally, the firm's value presents a negative relation with firm's size, measured by the *Total Assets.* This result is similar to several previous studies such as Rossi Junior and Laham (2008), Lin and Chang (2009) and Allayannis et al. (2012).

In the Models B and C the regressions, additionally, include the types of financial instruments used (forward, option and swap). This two models detailed the analysis, linking the specific contract used and the specific risk hedged (interest rate risk or foreign exchange risk). This procedure enables us to make wider inferences and to understand the importance of contract choice when a company is facing hedging activities. For example, in Model B we can observe that the variable connected with interest rate hedging with option contracts *(IRO)* has a negative impact on value, notwithstanding the fact that the

[21] R&D variable obtained from Amadeus Database has missing values in large scale. To prevent drastic reduction in the sample we follow Allayannis and Weston (2001) substituting the missing values for zero.

[22] Allayannis et al. (2012) also found a positive coefficient for the variable *Industrial Diversification*

coefficient of IR hedging with derivatives in general *(IRD)* be positive in the first model. This impact is statistically significant at 5%. The adverse effect of option contracts was also documented by Ahmed et al. (2013). In relation to the swap contracts, when with hedging interest rate purposes our results suggest that their use tend to increase value. However, the positive coefficient presents a non-significant value, which makes our findings on interest rate swaps (*IRS)* weaker.

Model C also reports fruitful results. Forward and swaps contracts used to manage the foreign exchange risk are positively and significantly associated to QTobin, thereby contributing to an increase in company's market value. By the other hand the option contracts present a negative coefficient, coinciding with results of Ahmed et al. (2013). This relation evidences that the use of option to hedge the FX risk may have some damaging effect on the wealth of shareholders, contrary to the general findings of foreign exchange derivatives impact. These differentiated behaviors of each specific derivatives face to hedging strategies bring us to reject the hypothesis H3. Actually, according to the results displayed on table 5, the type of contracts matters when we refer to the value creation and further, the effectiveness of some derivative contracts depend on the risk exposure hedged. Other explanatory variables, commonly named control variables, assume a similar conduct in model B and C than in the first model (Model A) and in this sense to avoid redundancy it will not be mentioned again.

Finally, the explanatory power of the OLS regressions is satisfactory high with an adjusted R-squared ranging between 35% and 36%. Identical studies have been found identical values for power explanation and therefore we can say that our set of variables permits explain the QTobin in a strong way.

7. Addressing Endogeneity

The OLS regressions explained above are a first step to produce elations about the consequences associated to the derivativhes use with hedging purposes. Nevertheless, it is necessary to be careful on our interpretations while an econometric problem - the endogeneity – can weaken these results. The hedging variables (*FXD, IRD, FXFW, FXS, FXO, IRS and IRO*) may be endogenous variables in the model, emerging issue about reverse causality between hedging variables and QTobin. There are explanatory factors included in the regressions that influence the value of the firm and simultaneously influence the likelihood to implement hedge strategies. For example, "if the firm's high Tobin's Q reflects the firm's higher investment opportunity, then as stated in the theory of optimal hedging, these firms have more incentives to hedge. In this way, the positive relation would indicate that firms with higher growth opportunities have an incentive to use derivatives rather than the use of derivatives increases the value of the firm" (Rossi Junior and Laham, 2008).

Actually, the concerns over endogeneity are commonly taken in account in the most relevant studies and one of the ways to alleviate the problem is perform an instrumental variables approach as in Campello et al. (2011), Allayannis et al. (2012), Ahmed et al. (2013), Marami and Dubois (2013) and Pérez-González and Yun (2013). Other alternative ways to mitigate the problem are, for instance, the adoption of a propensity score matching technique (Bartram et al., 2011) whereas others focus the study on an homogeneous sample, for example a sample that comprises only companies that operate in the same sector (Jin and Jorion, 2006 and Lin and Chang, 2009).

Therefore, we follow reference authors and implement an instrumental variables approach using the two-stage least squares method to avoid, as far as possible, the endogeneity issue. The next step and the more demanding is to find a set of valid instruments, which should be related to the hedging decisions and not directly impact firm value.

As Ahmed et al. (2013) it is employed the ratio of foreign revenue to total revenue, the existence of debt denominated in a foreign currency (dummy variable equal one if the

firm has foreign currency debt)[23] and the ratio of foreign assets scaled by total assets as instruments for foreign exchange risk. Unfortunately, the instruments employed by Ahmed et al. (2013) in regard to interest rate risk (fixed debt ratio and floating debt ratio) were not available on our databases neither explicitly mentioned on annual reports. To overcome the lack of available data and evolve the study it is established as instrumental variables a proxy for the debt maturity and a variable that captures the weight of interests paid on firm's activity. The variable *Interest Paid* is defined as the year total interest paid normalized by total revenue and the *Maturity* is defined as the ratio between log-term debt and total liabilities. In literature, the debt maturity has been shown as a factor that predicts the choice between fixed and floating debt (Dennis and Mihov, 2003) and further Beatty et al. (2011) suggest that "the maturity of existing debt tend to be positively associated with the propensity of derivative use".

First evidence that support the validity of these instruments is visible in the correlation matrix illustrated on the descriptive statistics section. For the variables used as instruments the correlation value is substantially high in respect to hedge variables (endogenous variables) and low in respect to firm value (QTobin) which is in concordance with the definition of instrumental variables (IV related to endogenous variable and unrelated with dependent variable). For example, the *Foreign Currency Debt* and the variable *FXD* have a correlation value equal to 0.2 while the correlation between the same IV (foreign currency debt) and *QTobin* is only 0.02. In turn, the correlation value among *Maturity* and the endogenous variable (*IRD*) is 0.45 while the correlation with market value (*QTobin*) is just 0.29.

To reinforce the robustness of the analysis, it is also considered the Staiger and Stock (1997) technic to identify weak instruments. This procedure proposes that the F statistics of first stage should be larger than the rule of thumb of 10 to reduce the risk of weak instruments.[24] This exercise was done and the results are satisfactory for the principal

[23] The variable "foreign currency debt" was obtained manually from the annual reports.

[24] Weak instruments are instruments with low correlation with endogenous variable. In the presence of these kinds of instruments (weak instruments) the estimations are bad or even poorer than the OLS ones.

variables on the model, namely *FXD* and *IRD* (F-statistic equal 11.2 in the first case and F-statistics equal 39 in the last one, both exceed the inferior limit of 10).

After these technical considerations associated to the complexity of instrumental variables approach, we will give attention to the empirically observations, presented on Table 6 and 7[25]. Table 6 illustrates the regressions related to interest rate risk hedge (Model 1; Model 2; Model 3) and Table 7 shows the coefficients concerning to foreign exchange risk hedge (Model 1; Model 2; Model 3; Model 4).

In Table 6, model 1, model 2 and model 3 show the impact of interest rate derivatives as a whole, the impact of IR swaps and the impact of IR option contracts respectively. In Table 7 the logic is similar and Model 1, Model 2, Model 3 and Model 4 illustrate respectively the effect of foreign exchange derivatives, FX swaps, FX forward contracts and finally foreign exchange option contracts. The control variables included are the same of OLS regressions had been explained in a previous section.

[25] The coefficients illustrate on table are the results obtained on the second stage.

Table 6: Instrumental Variables Regressions on the IR Derivatives and Firm Value

The Table 6 presents the coefficients estimated for the two-stage least squares method. The dependent variable is the QTobin (proxy to the firm market value) and the instrumental variables used are *Maturity* and *Interest Paid*. *Maturity* is defined as the ratio between long-term debt and total liabilities and *Interest Paid* is the total of interest paid per year scaled by the total revenue. The Model 1report the regression of interest rate derivatives (IRD) (Remember that the variables are defined as the notional value of derivatives to total assets). In turn, Model 2 and Model 3 show the regression of interest rate risk hedge with swap contracts (IRS) and options (IRO), respectively. The standard errors are represented in parentheses below each coefficient and the statistical significance are illustrated with the common symbols ***, ** and *, which denotes a significance at the 1% 5% and 10% level, respectively.

	Model 1	**Model 2**	**Model 3**
C	0,3877	0,3377	-0,5955
	(-0,711)	(-0,6764)	(-0,8736)
IRD	7,4337		
	(4,1033)***		
IRS		6,9876	
		(4,4913)***	
IRO			-79,6811
			(-2,9569)***
Leverage	-1,9016	-1,5826	2,6454
	(-2,5479)**	(-2,5651)**	(3,9532)**
Liquidity	-0,0046	-0,0117	-0,0999
	(-0,1999)	(-0,5600)	(-2,9078)***
ROA	0,0038	0,0040	0,0050
	(-0,9117)	(-1,0102)	(-0,7949)
Capital Expenditures	0,0119	0,0101	-0,0146
	(-1,2005)	(-1,1272)	(-1,1383)
R&D	-0,0159	-0,0151	-0,0095
	(-1,9362)*	(-1,9695)**	(-0,7400)
Dividend_Dummy	-0,3469	-0,3193	0,0624
	(-2,2946)**	(-2,3199)**	(-0,307)
Multinational_Div	0,1557	0,1297	-0,1729
	(1,7463)*	(-1,5833)	(-1,1323)
Industrial_Div	0,0202	0,0106	-0,1082
	(-0,2573)	(-0,1457)	(-0,9392)
Total Assets	-0,0811	-0,0782	-0,0162
	(-2,0996)**	(-2,2126)**	(-0,3481)
Year Dummies	YES	YES	YES
Industry Dummies	YES	YES	YES
R-Squared	-4,4470	-3,7444	-11,3326
Adjusted R-Squared	-4,6289	-3,9028	-11,7418
F-statistic	51,3122	52,6705	57,3848
Prob(F-statistic)	0,0000	0,0000	0,0000
Number obs.	682	682	686

Table 7: Instrumental Variables Regressions on the FX Derivatives and Firm Value

The Table 7 presents the coefficients estimated for the two-stage least squares method. The dependent variable is the QTobin (proxy to the firm market value) and the instrumental variables used are *Foreign Currency Debt, Foreign Revenue* and *Foreign Assets*. *Foreign Currency Debt* is a dummy variable equal one if the firm has debt denominated in a different currency; *Foreign Revenue* is the ratio of foreign revenue to total revenue*; ForeignAassets* is defined as the assets held in a foreign country to total assets. The Model 1 reports the regression of Foreign exchange rate derivatives (*FXD*). In turn, Model 2, Model 3 and Model 4 show the regression of foreign exchange rate hedge with swap contracts (*FXS*), forward contracts (*FXFW*) and options (*FXO*), respectively. The standard errors are represented in parentheses below each coefficient and the statistical significance are illustrated with the common symbols ***, ** and *, which denotes a significance at the 1% 5% and 10% level, respectively.

	Model 1	**Model 2**	**Model 3**	**Model 4**
C	-0,6809	-0,6574	-0,6511	-0,5589
	(-4,6445)***	(-4,1613)***	(-4,3752)***	(-3,1893)***
FXD	0,9730			
	(2,4645)**			
FXFW			1,0854	
			(2,6508)***	
FXS		-1,3017		
		(-0,2669)		
FXO				-7,8929
				(-1,6713)*
Leverage	1,1303	1,1256	1,1712	1,2970
	(13,4666)***	(11,5116)***	(13,3225)***	(9,0175)***
Liquidity	-0,0557	-0,0554	-0,0545	-0,0457
	(-8,3401)***	(-8,4754)***	(-8,0448)***	(-4,8949)***
ROA	0,0018	0,0047	0,0018	0,0046
	(-0,9976)	(2,4334)**	(-1,0393)	(2,9366)***
Capital Expenditures	-0,0109	-0,0114	-0,0109	-0,0120
	(-5,1860)***	(-5,5641)***	(-5,1477)***	(-5,1808)***
R&D	-0,0206	-0,0143	-0,0206	-0,0093
	(-5,0907)***	(-4,6395)***	(-5,1920)***	(-2,0349)**
Dividend_Dummy	-0,0500	-0,0683	-0,0498	-0,0243
	(-1,2145)	(-1,3996)	(-1,195)	(-0,4883)
Multinational_Div	0,0253	0,0833	0,0217	0,0694
	(-0,7325)	(2,6669)***	(-0,6251)	(2,2688)**
Industrial_Div	-0,0438	-0,0445	-0,0508	-0,0797
	(-1,8184)*	(-1,7793)*	(-2,0644)**	(-2,3047)**
Total Assets	0,0014	-0,0016	-0,0006	-0,0114
	(-0,1425)	(-0,1507)	(-0,0625)	(-0,8929)
Year Dummies	YES	YES	YES	YES
Industry Dummies	YES	YES	YES	YES
R-Squared	0,3733	0,3937	0,3569	0,2389
Adjusted R-Squared	0,3511	0,3726	0,3341	0,2124
F-statistic	20,5053	20,8481	20,6021	21,1321
Prob(F-statistic)	0,0000	0,0000	0,0000	0,0000
Number obs.	643	654	643	654

Despite the presence of endogeneity in our model, the regression results estimated by the two-stage least squares approach reinforces the elations taken by the OLS method. The coefficient of foreign exchange hedge with derivatives (Table 7) remains positive and significant (coefficient equal 0.973 and significant at 5%), which confirms again our H1 and make stronger the evidence about the positive impact of FX derivatives. The variable associated to interest rate hedge with derivatives stays positive and becomes statistically significant as well. This significance, combined with the positive signal support the second hypothesis proposed, i.e. support the hypothesis that interest rate derivatives used to hedging purposes by non-financial firms has a positive impact on firm value (H2).

When we add the type of contracts as a supplementary factor in our regression, we observe that IR swaps are value creating, contrary to option contracts that have a negative impact on firm value. In respect to foreign exchange, the forward contracts affect positively the wealth of shareholders while options are value destroying once again. The swap contracts to FX hedge become negative but non-significant, contrary to the OLS results, where the FXS show a positive trend. Again, the last hypothesis (H3) is rejected in response to different behaviors of different contracts. Unlike what happens in the OLS estimations, the explanatory power of these instrumental variables estimations can't be measured through adjusted R-squared due the fact that in this case the statistics R-squares don't have the natural interpretation and can even present negative values. Notice that the R-squared values in Table 6 are less than zero, which could lead to misinterpretations though the rationale for it is the possibility to the Residual Sum of Squares (SSR) for IV be larger than Total Sum of Squares (SST) (Jeffrey Wooldridge, 2000).

Summarizing the results in a gross view, we can state that derivatives are in general important instruments that permits increase firm value by reducing the risk exposure and the volatility of cash flows. The investors react positively to hedging activities and the firms that perform hedging policies have associated higher market values ("hedging premium"). However, we need to note that there are some type of contracts consecutively associated with a negative relationship with QTobin, is the case of option contracts (negative coefficient in *FXO* and *IRO*). Thus, the main conclusion from this study is the relevance of the choice about the type of contracts used to hedge combined with stronger empirical evidence that hedging with derivatives add value to the non-financial firms listed on the FTSE 350.

8. Conclusions

In this research we address the question of whether the hedging strategies with derivatives affect firm's market value. To that extent, we resort to a sample of non-financial firms listed on the FTSE-350 Index in time period of 2005 to 2013 (the final sample comprises 130 firms and a total of 1170 observations). Despite this question has already been studied by renowned authors, it remain unanswered, which improve the pertinence of the current scientific study.

We focus on the use of derivatives to hedge two distinct corporate risks, the foreign exchange rate risk and the interest rate risk. In addition, in secondary tests, it is considered also the type of derivatives used (forward, option and swaps) to manage each specific risk, providing a more detailed approach. Further, to a more accurate and informative analysis, the hedging variables are constructed employing the gross notional values of derivative contracts, contrary to a simple dummy variable commonly applied on previous literature that only distinguishes hedgers and non-hedgers. However, the unavailability of necessary information related to hedging derivatives, on databases compelled me to collect data manually from the annual reports, a lengthy process that doesn't allow us to present very large samples.

In a first step, to shed some lights on this topic we run a set of univariate tests along with an extensive descriptive analysis. Actually, when the sample are broken into hedger firms and non-hedger the differences show some tendency to firms that engage in hedging strategies be associated to higher market values. Based on the tests results we can also argue that hedgers are larger (Size), they level of internationalization are greater as well as their leverage ratio. From a time perspective arise certain equally relevant and interesting considerations. The usage of FX and IR derivatives presents a trend somewhat clear. While the percentage of foreign exchange derivatives to total assets increase more or less stable, the interest rate derivatives present an increase until 2009 followed by a decline in the next years. Interestingly, the more significant variations on the intensity of derivatives' use succeed on the financial crisis period (years 2008 and 2009), suggesting that the crisis phenomenon can had some impact on hedging behavior (Ahmed et al. 2013 don't found any effect of 2008-2009 crisis on hedging usage).

Subsequently, we employ a multivariate analysis using an OLS estimation method and also an Instrumental Variables approach, to avoid, as far as possible, the endogeneity issue due the reverse causality between firm value and the decision to hedge. Both models illustrate a positive and statistical significant impact of foreign exchange rate derivatives on firm market value. In case of interest rate derivatives the impact is also positive, albeit only the 2SLS model provides a statistical significant result. The resemblance of the results obtained from two different methods of estimation makes stronger our main conclusions and show that endogeneity problem is not likely to affect results.

When we account the specificity of derivative contracts the results demonstrate different behaviors of hedging. Certain contracts remain with the positive effect on value whereas other contracts become insignificant or even value-destroying, for instance, the option contracts. This conclusion leads us to argue that the choice of contract selected is also an important factor to consider, due the different reactions of investors face the different derivatives used.

Overall, the results suggest that market recognizes the effect of hedging and reward these policies with higher firm values. We have statistical significant as well as economically significant support to consider that hedging mechanism using derivatives contribute to the value creation. Further, the relation between hedging and firm value vary across derivatives used, which highlights the fact that some derivatives are more effective in reducing certain types of risks contributing to value creation.

Finally, this thesis may be helpful to improve firms hedging strategies, namely, thought the results of interaction between risks and contracts, which get lights on the most effective derivatives to hedge a specific risk. However, we need to list some limitations of our study. For instance, the choice of instruments employed in the IV method is a sensible issue and despite the fact that our IV have been tested, may exist more appropriate instruments. The relatively small sample may be another disadvantages of this research as well as the simplification employed to measure de Research and Development (R&D) variable. Consequently and according to the increase role of derivatives and the increased demand from investors, further research on this subject is necessary. In this specific line of investigation, will be interesting focus on samples comprising data on other European countries, namely, Portugal.

9. References

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